

### CH-47F Improved Cargo Helicopter (ICH)

The CH-47F Improved Cargo Helicopter (ICH) is a remanufactured version of the CH-47D Chinook equipped with the new T55-GA-714A engines. This Service Life Extension Program is intended to sustain the aging CH-47D airframes and extend the aircraft's life expectancy another 20 years. The CH-47D is a twin-turbine tandem rotor helicopter designed for combat and combat support heavy-lift cargo missions. ICH improvements include fuselage stiffening (to reduce vibrations in the cockpit area) and an integrated cockpit and digital communications for Objective Force compatibility. The ICH program will rebuild 300 systems.

OSD approved entry into Engineering and Manufacturing Development (EMD) in FY98 based on the perceived low technical risk, and delegated Milestone Decision Authority to the Army Acquisition Executive. The program has experienced aircraft delivery delays, changes to the Operational Requirements Document, and cost overruns that resulted in a Nunn-McCurdy breach and significant program restructuring in FY02. Additionally, due to contingency operations in Afghanistan, the unit scheduled for the Initial Operational Test and Evaluation (IOT&E) was unable to participate in the test, thereby forcing the event to be rescheduled. A Low-Rate Initial Production (LRIP) decision to purchase up to 30 aircraft was approved August 19, 2002. The IOT&E is now scheduled for FY04 and the Full-Rate Production decision in FY05.

The current Test and Evaluation Management Plan (TEMP) was approved in January 2002. A TEMP update is currently being staffed to support the restructured program with an anticipated approval date in FY03.

DOT&E approved an alternative Live Fire Test and Evaluation (LFT&E) plan after concurring with the Army's request for a waiver from full-up system-level testing in December 1997. The waiver certification to Congress was provided by the Under Secretary of Defense for Acquisition Technology and Logistics in March 1998. DOT&E approved the Army's LFT&E Strategy in January 1999. A damaged CH-47D production aircraft was repaired and is being used as the ground test vehicle (GTV) for the live fire test program. Live fire testing started in FY99.

#### TEST & EVALUATION ACTIVITY

The first refurbished EMD aircraft began developmental flight-testing on June 25, 2001, with the second EMD aircraft following on October 17, 2001. Together, the EMD aircraft have completed approximately 170 developmental test (DT) flight hours through November 2002. Following initial contractor shakeout flights by Boeing flight test pilots, Army test pilots have participated in most developmental flight-test events. Reliability and Maintainability (R&M) data was collected throughout DT. The second EMD aircraft has completed electromagnetic environmental effects (E3) testing at the Patuxent River E3 test facility.

The CH-47F performed an external lift demonstration with an M198 Howitzer along with associated internal loads, exceeding the requirements for weight, range, vertical rate of climb, and fuel reserve. In another flight demonstration, the ICH, weighted to simulate 31 combat-equipped troops and a crew of four, exceeded the objective distance requirement for troop transport capability. The CH-47F also demonstrated achievement of the LRIP exit criteria for self-deployment during flight-testing in November 2002.



*The CH-47 Improved Cargo Helicopter Upgrade performing external lift demonstration with an M-198 Howitzer.*

# ARMY PROGRAMS

During in-flight technical testing, the CH-47F demonstrated the capability to send and receive selected digital messages between aircraft and with a ground-based Force XXI Battle Command– Brigade and Below simulator. Compliance with the appropriate Joint and Army technical architecture is yet to be demonstrated. The CH-47F Program Manager has coordinated with the Army Systems Engineering Office (ASEO) to develop the required compliance matrix versus Joint Technical Architecture - Army Version 5.0 in FY99, with all applicable issues being resolved. In support of Milestone III, an update to the matrix and review by ASEO will occur in FY03.

The CH-47F met the LRIP vibration reduction Exit Criteria for the cockpit, but initial data suggests there may be an increase in vibration levels in the aft sections of the aircraft at medium to high gross weights. In response, further testing began in October 2002 that will collect comparative vibration data on CH-47D and CH-47F aircraft. This flight-testing will continue through January 2003.

The LFT&E program has prepared event design plans for testing and for modeling and simulation (M&S) as well as detailed test plans that describe the testing for the Cockpit Skin Panels, Cockpit Components, Fuel Subsystem, Propulsion System, and Engine Nacelle Fire Suppression System. Planning for the Fuselage Tunnel Flight Controls System started during FY02. The initial M&S for the baseline CH-47D and the CH-47F ICH has been completed. It will be updated at the conclusion of the live fire tests to incorporate the lessons learned from the testing.

The program initiated ballistic testing of the Cockpit Skin Panels in FY99, and completed all the planned shots. Testing of the T55 engine and fuel subsystem started in FY00 and was completed in FY02. Fire Suppression System testing started in FY02, while the Cockpit Component testing will begin in FY03. In addition, as part of the DOT&E Joint Live Fire (JLF) program, ten ballistic tests and one structural fatigue test were performed for the CH-47D rotor blades. Since these blades are the same as those to be used on the F-model, the data derived from the JLF program is directly applicable to the CH-47F.

## TEST & EVALUATION ASSESSMENT

Overall, prospects for successful demonstration of system effectiveness are good. Concerns about system reliability and vibrations pose moderate risk to aircraft suitability and the anticipated reductions in Operations and Support costs.

LRIP exit criteria for external loads, troop transport, self-deployment, and Joint Variable Message Format message transfer were successfully demonstrated during technical testing.

Stiffening of the fuselage has reduced vibration levels in the cockpit and meets LRIP exit criteria. However, certain flight test instruments and the operators have noted vibrations in the aft section, prompting concerns about the long-term reliability of aircraft components as well as fatigue life for airframe structure in the aft section. The aft section stress and vibration are under investigation.

Army test pilots have identified 18 issues related to cockpit configuration, displays, illumination, and cooling. The test report that describes these issues in detail and the program manager's corrective action plan are near completion.

Reliability testing to date has revealed failures that are common to legacy CH-47D aircraft. Based on this data, the CH-47F is not expected to demonstrate attainment of the Mean Time Between (MTB) Mission Abort requirement by Milestone III. The MTB Essential Maintenance Action, the MTB Mission Affecting Failure, and the MTB Unscheduled Maintenance Action requirements are all currently on track to be achieved by Milestone III. CH-47F data indicates an improvement in all four reliability measures over the CH-47D.

The CH-47F LFT&E program is a robust program. Test data from the Army's CH-47F LFT&E Program and the DOT&E Joint Live Fire program of the baseline CH-47D will support an adequate evaluation of the CH-47F. The only LFT&E concern at this time is that, at the completion of live fire testing, damage to the GTV may preclude dynamic testing of the main rotor blades.